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than many a highly-trained missionary. He formed the natives of a considerable district into a home-guard, which successfully defended it from all the raids of the slave-hunters. One principal cause of the great influence of Mackay of Uganda, whose recent death has thrilled the Christian world with a feeling akin to dismay, after the spirit which animated him, was the fact that he was a practical machinist It is, in truth, not too much to say that what Africa needs most now is not university men and highly-educated teachers, but mechanics and artisans, farmers and gardeners, actuated by the same spirit.

Nor can this indifference spring from timidity. The negro's record in the Civil War amply proves that he is not daunted by perils, nor does he shrink from privations in a noble cause. His apathy is the harder to understand from the fact that nothing to-day is surer to win the attention and admiration of the world than self-sacrificing work in Africa. That this recognition is not reserved for the white man is shown by the honors heaped upon Bishop Crowther, a Yoruba slave, for his services in the Niger valley, and the affectionate regard of all who have followed Stanley's adventurous life for his faithful Zanzibari, Uledi. A career is surely open to the ambitious American negro in Africa, success in which would lift his whole race while aiding in the redemption of a continent. Why does he not enter it?

JAMES M. HUBBARD.

THE USELESSNESS OF FLYING-MACHINES.

AIR-SHIPS have had an exhaustive trial, and their limitations are now recognized by all intelligent investigators. Any vessel which depends for its upward motion upon its displacement of air must, of necessity, be so large as to preclude the possibility of propelling it against even a moderate breeze. Helpless and inert as an iceberg in the Gulf Stream, it must float wherever the aërial currents choose to carry it. Few, even of the most visionary enthusiasts, now really believe that the day will ever come when buoyant air-ships will navigate the heavens in any governable direction.

With flying-machines, however, the case is radically different. In the first place, the flying-machine follows the analogy of nature as no air-ship ever could. Ships float on the water in very much the same fashion that fish and many aquatic birds float in or upon it; but the balloon finds no prototype in its sphere. No bird or insect exists that can for an instant support itself motionless in the air. The specific gravity of water and that of most animals are so nearly the same that an equipoise is easily established in various ways. But the specific gravity of air is so very much less than that of most of the other forms of matter that an equipoise is very hard to establish. As has been observed, no living animal can support itself in the air without supplementing the specific gravity of the air by an expenditure of muscular energy, and in most cases this expenditure is very large.

It is, then, only by means of some strong, light structure, *plus* a large amount of energy, that we may hope to imitate nature and traverse the heavens with both speed and certainty of course. But when the inevitable conditions are once accepted, the outlook for success is by no means discouraging. The obstacles in the way of a successful flying-machine are such that any decade of our age of aggressive science may surmount them. There is nothing at all absurd in the notion that men may learn to fly. Not by means of their own muscles, of course,—nobody now expects that,—but by means of mechanical ingenuity, linked with the tremendous power of steam or with the magic of that wonder-working force which we call electricity. At the present time there is a general feeling, not only among wild enthusiasts, but among men of sober judgment, both in the scientific and in the business world, that a practical flying-machine is among the near possibilities of the future. Learned and conservative societies have lent to this belief a very considerable degree of favor, while the faith of the commercial world is attested by the recent formation in a western city of a company with an enormous capital which is to be devoted entirely to the building of flying machines.

But when one examines carefully into the possible utility of flying-machines, he is forced to the conviction that no great benefits to mankind are reasonably to be expected from even the most triumphant success in this line of invention. It is really curious that so many people assume without reflection that a successful flying-machine would mean either increased speed or increased carrying power over our present methods of transportation. An American journal of weight and ability recently gave editorial utterance to this remarkable statement: "The successful trial of an air-ship would in twenty-four hours' time cut down by half the value of all the railroads and steamships in the world, because it would afford an opportunity of cheapening to an incredible extent the cost of transporting persons and merchandise." This is sheer nonsense; and it is worthy of confutation only because it is a kind of nonsense to which people who talk on this subject seem to fall victims in a very unthinking way.

The one sole advantage of aërial transit lies in the directness of route which it would find possible. A flying car could (theoretically) go from New York to San Francisco, or from London to Constantinople, in a line much more nearly straight than is now possible for a railroad or a steamship. But what other advantage could possibly attend aërial transit? Many persons speak of "travelling through the air" as if air would be an entirely novel medium to travel through. They seem not to realize that steamships and railroad trains at the present day travel through the air, with the great additional advantage of getting a solid base beneath the air to rest upon. Would a cargo of goods or a carload of passengers lose its weight if it were elevated above the earth's surface? If not, then this weight must rest on something. And if it rests upon the air, the friction will be far greater than if it rested upon the steel rails and well-lubricated wheels of a first-class railroad. The more yielding the substance upon which a moving weight slides, the greater the friction. As a ship, resting on the yielding sea, finds a much greater resistance to its motion than does the same weight resting upon steel rails, so would a vessel resting upon the air find a much greater friction to overcome than if it rested upon the sea. An express train now travels through the air, and through no other medium. By resting upon the earth it secures a grip for its driving-wheels and a hard, smooth surface to slide upon. What advantage could result from increasing the friction, and putting forth a tremendous power to support the weight of the train, at the same time removing the driving-wheels to a region where they could get no grip save upon the thin and fleeing air?

And if it is absurd to hope for an increase of speed, it is even more palpably impossible to secure an increase of transporting power by means of flying-machines. A moment's sane reflection ought to convince any man that the power consumed in lifting a dead-weight a hundred feet into the air must enormously exceed the power necessary to move the same weight an equal distance along the earth's surface. Even so crude a vehicle as a stone-drag enables a horse to pull for miles a load of rocks which he could not lift a thousand feet. Two horses will trot and pull a hundred passengers along the smooth metals of a tramway. Of how many horses would the strength be required to support the same car full of passengers in mid-air an hour, to say nothing of moving it along rapidly at that elevation? A force of ten pounds, advantageously applied, will move a ton in a horizontal direction. To sustain the ton in the air and simultaneously move it at the same speed in a horizontal direction obviously would require a force of ten pounds *plus two thousand pounds!* Here, again, one is constrained to ask: What advantage is it to put forth the enormous power necessary to sustain the freight in mid-air, when the weight might just as well rest peacefully upon the earth, the transporting power required being in both cases substantially the same? The whole absurdity originates in the unthinking notion that a bird on the wing weighs less than he does when sitting on a perch.

No triumph of ingenuity, no availability of new substances, such as aluminium, no application of electricity or other power, will ever enable man and freight to travel supported on the air more speedily or cheaply than, with the same advantages of material and power, they can be transported through the air while resting on the earth. So long as the force of gravity remains unaltered, transit through mid-air must, of necessity, be handicapped by disadvantages which no conceivable mechanism could overcome—disadvantages which forever preclude serious competition with transit on the earth's surface.

Flying-machines are among the near possibilities—an enthusiast might almost say probabilities. Man may yet harness himself into a light, tough frame-work of aluminium, and, compelling the electric current completely to his will, mount the ether like a lark or cleave the clouds like an eagle. But the world has as little practical use for flying-machines as it has for the north pole. Scientists would be deeply interested in them; the rich might conceivably use them as luxurious playthings; adventurous cranks would play mad pranks with them, not "before high heaven," but in high heaven; and the managers of agricultural fairs and Fourth-of-July entertainments would hail them with joy as the legitimate heir to that old favorite, the balloon ascension. But the spectacle of a perfected flying-machine to-morrow curving its graceful spirals above the New York Stock Exchange need not shake by a ripple the watery instability of the most dropsical railroad stock in that hydropathic centre. The mass of mankind will live and move forever upon the earth's surface. The power that binds solid substances to that surface will never be defied or evaded to any beyond the most limited extent.

ARTHUR MARK CUMMINGS.

HOW TO TEACH CITIZENSHIP.

"OH, I NEVER read editorials," was the reply made by an intelligent-looking young paying-teller in one of Boston's national banks, when asked if he had read a certain newspaper editorial dealing with a prominent economic question. Even more distressing was the confession of a young citizen, born and bred in New York city, in reply to a question as to how he should vote at the recent municipal election, that he did not know who the candidates were. When told that Mr. Grant was the Tammany candidate, he expressed the hope that he would be defeated, as he "never did like the Grant family"!